Course guide
205605 - 205605 - Multibody System Dynamics

Unit in charge: Terrassa School of Industrial, Aerospace and Audiovisual Engineering
Teaching unit: 712 - EM - Department of Mechanical Engineering.
Degree: MASTER'S DEGREE IN RESEARCH IN MECHANICAL ENGINEERING (Syllabus 2021). (Compulsory subject).
Academic year: 2022  ECTS Credits: 3.0  Languages: Catalan

LECTURER

Coordinating lecturer: Rosa Pàmies Vilà
Others: Josep Maria Font Llagunes
Albert Peiret Gimenez

PRIOR SKILLS

Knowledge of the kinematics and dynamics (vector formulation) of rigid bodies.

DEGREE COMPETENCES TO WHICH THE SUBJECT CONTRIBUTES

Specific:
CE7-MUREM. Use numerical simulation tools for the design, calculation and manufacture of components, systems and mechanical installations.
CE9-MUREM. Identify research trends in the area of Mechanical Engineering, the different models of research units, as well as the mechanisms for managing, disseminating and protecting R&D&i.

General:
CG1-MUREM. Solve problems of Mechanical Engineering through the application of mathematical, analytical, scientific, instrumental, technological and management aspects.
CG4-MUREM. Research and innovate in the field of Mechanical Engineering.
CG8-MUREM. Develop the learning skills that allow mastering the current and future activities of Mechanical Engineering and the continuous development of the field.

TEACHING METHODOLOGY

- Theoretical and practical face-to-face class (classroom, computer room and laboratory).
- Guided autonomous learning.
- Cooperative learning.
- Learning based on projects, problems and case studies.

LEARNING OBJECTIVES OF THE SUBJECT

Learning objectives
The general learning objectives of the course are:
- Know tools for modelling mechanical multibody systems (types of coordinates, kinematic constraints, etc.).
- Apply computational algorithms to solve kinematic and dynamic problems.
- Use graphical interfaces for visualization of movement.

Attitudes, values and norms
This course unit will help students to develop in a number of areas, including effort, discipline, collaboration and teamwork, analysis of complex computational problems, spoken and written communication, and preparation of multimedia material.
STUDY LOAD

<table>
<thead>
<tr>
<th>Type</th>
<th>Hours</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self study</td>
<td>48,0</td>
<td>64.00</td>
</tr>
<tr>
<td>Hours small group</td>
<td>12,0</td>
<td>16.00</td>
</tr>
<tr>
<td>Hours large group</td>
<td>15,0</td>
<td>20.00</td>
</tr>
</tbody>
</table>

Total learning time: 75 h

CONTENTS

**Modelling of mechanical systems**

**Description:**

**Related competencies:**
CG1-MUREM. Solve problems of Mechanical Engineering through the application of mathematical, analytical, scientific, instrumental, technological and management aspects.
CE7-MUREM. Use numerical simulation tools for the design, calculation and manufacture of components, systems and mechanical installations.

**Full-or-part-time:** 9h
- Theory classes: 3h
- Laboratory classes: 1h
- Self study: 5h

**Kinematics**

**Description:**

**Related competencies:**
CG4-MUREM. Research and innovate in the field of Mechanical Engineering.
CG8-MUREM. Develop the learning skills that allow mastering the current and future activities of Mechanical Engineering and the continuous development of the field.
CG1-MUREM. Solve problems of Mechanical Engineering through the application of mathematical, analytical, scientific, instrumental, technological and management aspects.
CE9-MUREM. Identify research trends in the area of Mechanical Engineering, the different models of research units, as well as the mechanisms for managing, disseminating and protecting R&D&I.
CE7-MUREM. Use numerical simulation tools for the design, calculation and manufacture of components, systems and mechanical installations.

**Full-or-part-time:** 30h
- Theory classes: 6h
- Laboratory classes: 4h
- Self study: 20h
**Dynamics**

**Description:**

**Related competencies:**
CG4-MUREM. Research and innovate in the field of Mechanical Engineering.
CG8-MUREM. Develop the learning skills that allow mastering the current and future activities of Mechanical Engineering and the continuous development of the field.
CG1-MUREM. Solve problems of Mechanical Engineering through the application of mathematical, analytical, scientific, instrumental, technological and management aspects.
CE9-MUREM. Identify research trends in the area of Mechanical Engineering, the different models of research units, as well as the mechanisms for managing, disseminating and protecting R&D&i.
CE7-MUREM. Use numerical simulation tools for the design, calculation and manufacture of components, systems and mechanical installations.

**Full-or-part-time:** 36h
- Theory classes: 6h
- Laboratory classes: 7h
- Self study: 23h

---

**GRADING SYSTEM**

Global course grade (NF) will be based on the following partial grades:
Nac = Continuous evaluation grade (deliveries, practices, works, projects and presentations)
Nef = Final exam grade
NF = 0.50 * Nac + 0.50 * Nef

Reevaluation:
Students enrolled in the subject who have obtained a final grade (NF) greater than or equal to 2.0 but less than 5.0 may apply. The reevaluation exam has the same format as the ordinary final exam. The revaluation exam grade (Nre) and the continuous evaluation grade provide the revalidation grade (NRevaluation)

NRevaluation = 0.50 * Nac + 0.50 * Nre

If NRevaluation ≥ 5, the final grade of the subject will be passed, with a grade of 5.0.
If NRevaluation <5, the final note of the asignatura will be suspended and the numerical qualification after the reevaluation will only replace to the initial in case of being higher.

---

**BIBLIOGRAPHY**

**Basic:**